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**TITLE: COMBINATION LED FLASHLIGHT AND GARAGE DOOR  
TRANSMITTER**

This utility patent application is based on the provisional patent application  
(60/492,889) filed on August 5, 2003.

**BACKGROUND OF THE INVENTION**

1. Field of the Invention:

This invention relates to flashlights, and more particularly to flashlights that can be  
used to open and close garage door openers.

2. Description of the Related Art:

Small portable flashlights kept in a motor vehicle are relatively common. Typically  
they are kept in a glove box and only used in an emergency. Because the battery in the  
flashlight slowly discharges over time and because the flashlight is not tested regularly, the  
flashlight does not operate when needed.

It is well known that LED bulbs are more energy efficient, have longer lives, and are

1 more mechanically reliable than incandescent bulbs. Because of these benefits, they are  
2 commonly used in small, portable lights such as flashlights. LED flashlights found in the  
3 prior art generally consist of one or more LED bulbs located inside a housing containing a  
4 plurality of batteries. Because LEDs require 5 volts of DC current for optimal illumination,  
5 at least three AA or AAA batteries connected in a series are used. As a result, most bright  
6 LED flashlights have relatively large housings. When an LED flashlight with a smaller  
7 housing is desired, for example with an LED key ring or fob, a single battery may be used but  
8 the flashlight illumination will be substantially reduced.

9 An LED flashlight that overcomes the above drawbacks is disclosed in a U.S. Patent  
10 Application (Serial No. 10/104,895) filed by the inventor on March 22, 2002. Such a  
11 flashlight uses a voltage tripler and regulator that enables the use of a single AA or lithium  
12 battery. The voltage tripler is a "step-up power component" that raises the battery voltage  
13 from 1.5 volts to approximately 5 volts which, is required to sufficiently energize one or  
14 more LEDs. Garage door opener transmitters found in the motor vehicle are typically used  
15 on a daily basis. When the battery in the transmitter is discharged to a lower level, the  
16 transmitter does not operate, thus informing the user that the battery needs to be replaced.

17 What is needed is a small portable flashlight for use in a motor vehicle that informs  
18 the user that the battery is adequately charged for operation.

## 20 SUMMARY OF THE INVENTION

21 It is an object of the present invention to provide a portable flashlight for use in a  
22 motor vehicle.

23 It is another object of the present invention to provide such a flashlight that uses a

1 battery that is used frequently, to inform the user that it is adequately charged for operation.

2 It is another object of the present invention to provide such a flashlight that is  
3 combined with another electronic device frequently used in the motor vehicle which uses the  
4 same battery.

5 These and other objects of the present invention are met by a combination flashlight  
6 and remote garage door opener transmitter. The device includes an LED light circuit, a  
7 power circuit and a voltage multiplying circuit all mounted on a printed circuit board. The  
8 LED light circuit includes at least one main LED that optimally operates at 5.0 volts. The  
9 power circuit includes at least one single AA or AAA battery mounted inside the flashlight  
10 and electrically connected to the voltage multiplying circuit that raises and maintains the  
11 battery voltage from 1.5 volts to approximately 5 volts.

12 Connected to the voltage detector circuit is a trainable, garage door opener transmitter  
13 circuit that generates a control signal that communicates with a garage door opener receiver.  
14 The transmitter circuit is also connected to the voltage multiplying circuit to operate at 5.0  
15 volts. During use, the working voltage of the device is maintained at 5.0 volts for operating  
16 both the LED circuit and the transmitter circuit. Since, the two circuits use the same battery,  
17 operation of one circuit informs the user of the operational status of the other circuit.

## 19 DESCRIPTION OF THE DRAWINGS

20 Fig. 1 is perspective view of the combination LED flashlight and garage door  
21 transmitter.

22 Fig. 2 is a top plan view of the invention.

23 Fig. 3 is a sectional, top plan view of the invention.

1 Fig. 4 is a left side elevational view of the invention.

2 Fig. 5 is a left side elevational view of the device showing the location of the battery,  
3 printed circuit board, and the LED.

4 Fig. 6 is a right side elevational view of the device showing the location of the printed  
5 circuit and LED.

6 Fig. 7 is an electrical diagram of the LED light circuit, the voltage multiplying circuit  
7 and the power circuit.

8 Fig. 8 is a block diagram of the device.  
9

#### 10 **DESCRIPTION OF THE PREFERRED EMBODIMENT(S)**

11 Referring to the accompanying Figs. 1-8, there is shown and described a combination  
12 LED flashlight and garage door opener transmitter, generally referred to as device 10. The  
13 device 10 includes an elongated hollow body 12, with a closed end 13 and a transparent main  
14 lens 28 that attaches over an open end 14. The body 12, which is made of a clear or colored  
15 plastic or similar material, is made of two half components 17, 18 that snap together along  
16 the body's central longitudinal axis 19. Formed on the closed end 13 of the body 12 is an  
17 optional key ring 20.

18 The LED flashlight component is nearly identical to the LED flashlight disclosed in  
19 U.S. Patent Application No. 10/104,895, filed March 22, 2002, which is now incorporated by  
20 reference herein.

21 Attached over the open end 14 of the main body 12 is a transparent lens 28 made of  
22 plastic or similar material. The lens 28 snaps into the perimeter edges of two half  
23 components 17, 18 that form the open end 14.

1 Formed on the outer surface of each main body 12 are two switch holes 30, 32  
2 through which a main on/off switch button 34, garage door function button 40, 40' extends,  
3 respectively.

4 As shown in Figs. 3-6, an elongated printed circuit board 42 is longitudinally aligned  
5 inside the main body 12. Aligned perpendicularly on the proximal end of the printed circuit  
6 board 42 is a smaller, multiple LED printed circuit board 43. The main printed circuit board  
7 42 is slightly offset from the longitudinal axis 19 of the main body 12, thereby creating a  
8 longitudinally aligned cavity 50 inside the main body 12 for a single battery AAA 55.

9 Connected to the printed circuit board 43 is a trainable, garage door opener  
10 transmitter circuit, generally denoted as 46 in Fig 8 that generates a control signal that  
11 communicates with a garage door opener receiver 95. The circuit 46 includes an encoder  
12 circuit 47 and an antenna 48 that activates a garage door opener (not shown).

13 Fig. 7 is a schematic of the printed circuit board 42 used in the device 10. Each  
14 printed circuit board 42 includes a LED light circuit 80, a power circuit 85, and a voltage  
15 multiplying circuit 90. The LED light circuit 80 includes at least one LED bulb 65 connected  
16 to three NPN transistors 81 – 83 connected in a series to a CMOS semi-conductor 84. An  
17 optional dimmer switch 98 is connected between the CMOS semi-conductor 84 and the LED  
18 bulb 65. The power circuit 85 includes a main on/off switch 96 and four NAND logic gates  
19 86 – 89 that control the switch control logic and the brightness control logic. The voltage  
20 multiplying circuit 90 includes a synchronous boost converter 91 that connects to a 1.5 volt  
21 battery 55 and triples the output voltage to approximate 4.5 volts and maintains the output  
22 voltage at or near 4.5 volts.

23 In the preferred embodiment, the synchronous boost converter 91 is a six lead thin

1 SOT with a frequency, step-up DC/DC converted capable of supplying approximately 5.0V at  
2 150 MA from a single 1.5 volt battery input. Such converters contain an internal NMOS  
3 switch and a PMOS synchronous rectifier that multiple and automatically adjust and  
4 maintains output voltage at a desired voltage as the input voltage drops. An example of a  
5 synchronous boost converter (Model No. LTC 3400) that may be used is sold by Linear  
6 Technology Corporation located in Milpitas, California.

7 Fig. 8 is a block diagram of the device showing the relative connections of the LED  
8 the garage door transmitter circuit 46, the LED light circuit 80 and the voltage multiplying  
9 circuit 90.

10 Table 1 lists the codes, names, and functions of the components shown in Fig. 8.

11 In compliance with the statute, the invention described herein has been described in  
12 language more or less specific as to structural features. It should be understood, however,  
13 that the invention is not limited to the specific features shown, since the means and  
14 construction shown, is comprised only of the preferred embodiments for putting the invention  
15 into effect. The invention is therefore claimed in any of its forms or modifications within the  
16 legitimate and valid scope of the amended claims, appropriately interpreted in accordance  
17 with the doctrine of equivalents.

**TABLE 1.**

<b>Designators</b>	<b>Qty</b>	<b>Description</b>
C1	1	Miniature Electrolytic Capacitor
C2	1	Chip Capacitor
C3	1	Chip Capacitor
C4	1	Chip Capacitor
C5	1	Miniature Electrolytic Capacitor
C6	1	Chip Capacitor
C8	1	Chip Capacitor
C9	1	Chip Capacitor
D1	1	Schottky Barrier Rectifier
D2	1	"n"
LED1	1	Nichia White LED Lamp
Q1	1	NPN Transistor
Q2	1	NPN Transistor
Q3	1	NPN Transistor
R1	1	Chip Resistor
R10	1	Chip Resistor
R11	1	Chip Resistor
R12	1	Chip Resistor
R13	1	Chip Resistor
R14	1	Chip Resistor
R15	1	Chip Resistor
R2	1	Chip Resistor
R3	1	Chip Resistor
R4	1	Chip Resistor
R5	1	Chip Resistor
R6	1	Chip Resistor
R7	1	Chip Resistor
R8	1	Chip Resistor
R9	1	Chip Resistor
PCB	1	Printed Circuit Board
U1	1	Synchronous Boost Converter
U2	1	CMOS Quad 2-input NAND gate